Research Proposal of the Thesis Entitled

The Integration of Artificial Intelligence as a Means to Reduce Case Pendency in Indian Judicial System

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By

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1. Introduction

"Justice Delayed Is Justice Denied. "- William E Gladstone

One of the major challenges of the Indian judiciary is the high number of pending legal cases in various courts, which has a direct bearing on the effectives and timeliness of the justice delivery process (Krishna et al., (2018)). Artificial Intelligence (AI) could be instrumental in clearing such backlog by examining those processes which can be automated. AI can rank cases according to how urgent or complex they are, enabling the courts to give priority to more complex and urgent matters. Using AI based predictive analytics, the previous judgements of different cases can be studied which would help future negotiators to understand the possible outcomes. This will help in better application of the negotiation skills thereby shorting the argument cycle in routine cases (Srivastava, S.K., et al., (2023)).

AI based tools are very handy in legal research work as it has the ability to scan a large legal database to gather the relevant aspects of a given case, thus reducing the preparation time for the lawyers, judges alike. By automating the process of case management, scheduling cases, filing case papers and tracking individual case progress becomes easy. The details are available to all the stakeholders at the click of a button and there is transparency in the system thereby helping in reducing backlogs. Since human bias is removed in a AI-powered system and there is regular monitoring, the load on the courts reduces considerably.

Another challenge is processing legal documents in different languages. Natural Language Processing (NLP) can facilitate instant translation of court documents across several languages, so that language barrier is removed in justice delivery. AI helps in detailed analytics and a root cause analysis to find the factors causing case delays and then these issues can be addressed separately. Additionally, it allows better resource allocation and reduces delay as more number of cases can be handled efficiently within the same time span.

2. Problem Statement

There is a huge pendency of cases in the Judicial courts of India for varied reasons ranging from administrative to personal reasons of the litigants which casts a doubt on the efficiency of the Justice delivery system. Artificial Intelligence (AI) has the potential to clear out this backlog due to the enhancement of different factors of the human-based judiciary system. AI can prioritize cases according to urgency and complexity, enabling courts to consider more

urgent cases more quickly. The predictions through AI-based predictive analytics might consider past decisions and outcomes in potential futures, which could potentially lead to negotiations in ordinary practice in contrast to what would likely be lengthy proceedings.

3. Aim

Utilise Artificial Intelligence based techniques to reduce the pendency of cases in Indian courts.

4. Objectives

- Objective 1: Design of Predictive Analysis based Judicial Decision Support System.
- Objective 2: Design of legal case rationale optimisation model.
- Objective 3: Develop machine learning model for prioritizing cases.
- Objective 4: To perform comparative analysis and apply summary evaluation measures to evaluate the proposed models.

5. Literature Review

Sl No	Year	Authors	Method Used	Results	Research Gap
1	2024	Srivastava, S.K., et al.	Utilized quantitative data re: Ai usage qualitative from legal perspective	40% less prep time greater productivity and efficiency	Concern about ethics and training requirements
2	2024	Ejjami, R., et al.	Hybrid design, including case and quantitative examination	Cut case backlogs by 30% and reduced trial time by 20%	Data privacy and algorithmic bias a concern
3	2023	Atabekov, A., et al.	Case reports, series, analysis, pattern analysis	Well demonstrated discrepancies	Regulations & Policy Bias, Biased Algorithm

4	2022	Tahura, U.S., et al.	Qualitative approach, Analysis of AI technologies	Improve process and case management consistencies	Transparency and ethical issue
5	2020	Antinucci, M., et al.	Convergence of AI and block-chain	Blockchain technology strengthens legal processes	General inability of AI in decision making
6	2020	Zhong, H., et al.	Automating analysis in legal documents	NLP advances legal document review & prediction	Only a portion of data & LLMs are sampled
7	2019	Scherer, M., et al.	Qualitative analysis of legal precedents, case studies, arbitration framework	Improved decision making	Transparency, accountability, ethical concerns
8	2019	Park, R., et al.	Qualitative, literature review based	Speed up on legal processing	AI working under International legal frameworks
9	2017	Pastukhuva. A., et al.	Qualitative approach analysed numerous AI models	Effective analysis of legal precedents	Lack of human discretion, Ethical biases.

6. Techniques Used

This section outlines the methods used for analysis.

- **PCA**. Principal Component Analysis (PCA) is a method which is used for data dimensionality reduction with covariant feature. This helps in representing data with fewer dimensions and to simplify the complex datasets.
- **GA**. Genetic Algorithm (GA) is a type of search and optimization. GA is based on the theory of evolution and are effective in situations where traditional methods fail when solving complex problems.

- **PSO**. PSO is a population based optimization technique. A group of particles is used to find the solution to a given complex problem. This method is based on the behavior of bird flocks.

7. Methodology

Step 1: Collection of Case Data

Step 2: Pre-processing of Case Data

- Remove Outliers in the Data
- Handle Missing Values in the Data
- Case Data Normalization

Step 3: Feature Selection and Extraction from the Database

Step 4: Hybrid GA and PSO model optimization

Step 5: Divide Data into Training /Test Set

- Training Dataset
- Test Dataset

Step 6: AI Model Development

- Predictive Analysis (Guilty/Not Guilty Outcomes)
- Q-Learning for Case Prioritization
- Transfer Learning

Step 7: Training the Models

Step 8: Fraud Detection

Step 9: Validation

Step 10: Measure Performance Metrics

Step 11: Alarming System for Stakeholders

8. Comparative Analysis

The comparison will be done by proposed model using Genetic Algorithm with Particle Swarm Optimization (GA-PSO) + Random Forest against other methods, which includes bagging, decision tree, and XG-Boost. In terms of accuracy, the proposed model stands out with an exceptional score of 0.986 or 98.6%. This is significantly higher than the other techniques,

which range from 0.74 for the decision tree to 0.81 for both bagging and XG-Boost, highlighting its well-rounded and effective approach to fraud detection.

While there are challenges such as biased AI algorithms and data privacy, AI can boost the efficiency of the Indian judiciary if it is accompanied by proper oversight and integration with human judgment to help reduce the backlog of pending cases **(Bhupatiraju et al., (2020))**.

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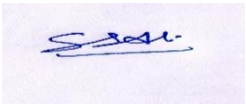
Signature : 

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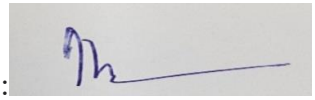
Signature : 

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